

## Claims

What is claimed is:

1           1.     An instrument for measuring particles of combustion exhausts  
2 comprising:  
3           a laser for producing a high intensity laser pulse;  
4           a sample cell for receiving combustion exhaust input and said high  
5 intensity laser pulse; and  
6           at least one detector for detecting a signal generated by particles in  
7 said received combustion exhaust input, said signal including laser induced  
8 incandescence (LII).

1           2.     An instrument for measuring particles of combustion exhausts  
2 as recited in claim 1 further includes a plurality of optical elements coupling  
3 said high intensity laser pulse to said sample cell.

1           3.     An instrument for measuring particles of combustion exhausts  
2 as recited in claim 2 wherein said plurality of optical elements include a  
3 plurality of cylindrical lenses.

1           4.     An instrument for measuring particles of combustion exhausts  
2 as recited in claim 1 further includes a plurality of focusing elements coupling  
3 said signal generated by particles in said received combustion exhaust input  
4 in said sample cell to said at least one detector.

1           5.     An instrument for measuring particles of combustion exhausts  
2 as recited in claim 4 wherein said plurality of focusing elements include a  
3 plurality of spherical lenses.

1           6.     An instrument for measuring particles of combustion exhausts  
2 as recited in claim 4 further includes a filter for filtering said signal generated  
3 by particles in said received combustion exhaust input.

1           7.     An instrument for measuring particles of combustion exhausts  
2 as recited in claim 1 further includes signal conditioning electronics coupled  
3 to said at least one detector.

1           8.     An instrument for measuring particles of combustion exhausts  
2 as recited in claim 7 wherein said signal conditioning electronics includes a  
3 peak detector.

1           9.     An instrument for measuring particles of combustion exhausts  
2 as recited in claim 7 wherein said signal conditioning electronics includes a  
3 calibration multiplier.

1           10.    An instrument for measuring particles of combustion exhausts  
2 as recited in claim 7 wherein said signal conditioning electronics includes a  
3 display for displaying particle measurements.

1           11.    An instrument for measuring particles of combustion exhausts  
2 as recited in claim 1 includes a display coupled to said at least one detector  
3 for displaying data related to mass concentration, number density, and  
4 particle size of particles in said received combustion exhaust input.

1           12.    An instrument for measuring particles of combustion exhausts  
2 as recited in claim 1 wherein said at least one detector for detecting a signal  
3 generated by particles in said received combustion exhaust input detects  
4 said signal during transient operation of an engine.

1           13.    An instrument for measuring particles of combustion exhausts  
2 as recited in claim 1 wherein said at least one detector for detecting a signal  
3 generated by particles in said received combustion exhaust input includes at  
4 least one photo-multiplier tube (PMT) detector.

1           14.    An instrument for measuring particles of combustion exhausts  
2 as recited in claim 1 wherein said at least one detector for detecting a signal  
3 generated by particles in said received combustion exhaust input includes a  
4 pair of photo-multiplier tube (PMT) detectors.

1           15.    An instrument for measuring particles of combustion exhausts  
2 as recited in claim 14 includes signal conditioning electronics coupled to  
3 each of said pair of photo-multiplier tube (PMT) detectors.

1           16.    An instrument for measuring particles of combustion exhausts  
2 as recited in claim 1 includes a dilution tunnel coupling said combustion  
3 exhaust input to said sample cell.

1           17.    A method for measuring particles of combustion exhausts  
2 comprising the steps of:  
3           utilizing a laser, producing a high intensity laser pulse;  
4           receiving a combustion exhaust input and said high intensity laser  
5 pulse in a sample cell; and  
6           detecting a signal generated by particles in said received combustion  
7 exhaust input, said signal including laser induced incandescence (LII).

1           18.    A method for measuring particles of combustion exhausts as  
2 recited in claim 17 further includes the steps of conditioning said detected  
3 signal and displaying data related to the particles in said received  
4 combustion exhaust input.

1           19.    A method for measuring particles of combustion exhausts as  
2 recited in claim 18 wherein the step of displaying data related to the particles  
3 in said received combustion exhaust input includes the steps of displaying  
4 data related to mass concentration, number density, and particle size of  
5 particles in said received combustion exhaust input.

1           20.    A method for measuring particles of combustion exhausts as  
2 recited in claim 17 wherein the step of detecting a signal generated by  
3 particles in said received combustion exhaust input includes the detecting a  
4 signal generated by particles in said received combustion exhaust input  
5 during transient operation of an engine.